

1 WHAT IS CLAIMED IS:

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3 1. A molecular sieve comprising an oxide of silicon and an oxide of zinc and having the
4 framework topology of zeolite beta, wherein the molecular sieve contains zinc in its
5 crystal framework.

6

7 2. The molecular sieve of claim 1 wherein the oxides of silicon and zinc are the only
8 oxides in the framework of the molecular sieve.

9

10 3. A molecular sieve having the topology of zeolite beta, and having a composition, as
11 synthesized and in the anhydrous state, in terms of mole ratios as follows:

12	SiO_2/ZnO	10-100
13	M/SiO_2	0.01-0.1
14	Q/SiO_2	0.07-0.14

15

16 wherein M is lithium or a mixture of lithium and another alkali metal; and Q
17 comprises a tetraethylammonium cation, wherein the molecular sieve contains zinc in
18 its crystal framework.

19

20 4. A molecular sieve comprising silicon oxide, zinc oxide, and an oxide selected from
21 aluminum oxide, boron oxide, gallium oxide, iron oxide, titanium oxide, vanadium
22 oxide, zirconium oxide, tin oxide or mixtures thereof and having the framework
23 topology of zeolite beta, wherein the molecular sieve contains zinc in its crystal
24 framework.

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26 5. The molecular sieve of claim 4 comprising silicon oxide, zinc oxide and aluminum
27 oxide.

28

29 6. The molecular sieve of claim 4 comprising silicon oxide, zinc oxide and boron oxide.

30

31 7. The molecular sieve of claim 4 comprising silicon oxide, zinc oxide and gallium
32 oxide.

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2 8. The molecular sieve of claim 4 comprising silicon oxide, zinc oxide and titanium
3 oxide.

4

5 9. A molecular sieve having the topology of zeolite beta, and having a composition, as
6 synthesized and in the anhydrous state, in terms of mole ratios as follows:

7	SiO_2/ZnO	10-100
8	SiO_2/W	30-250
9	M/SiO_2	0.01-0.1
10	Q/SiO_2	0.07-0.14

11

12 wherein W is an oxide of aluminum, boron, gallium, vanadium, iron, titanium or
13 mixtures thereof, M is lithium or a mixture of lithium and another alkali metal; and Q
14 comprises a tetraethylammonium cation, wherein the molecular sieve contains zinc in
15 its crystal framework.

16

17 10. A method of preparing a crystalline material comprising an oxide of silicon and an
18 oxide of zinc and having the framework topology of zeolite beta, wherein the
19 molecular sieve contains zinc in its crystal framework, said method comprising
20 contacting in admixture under crystallization conditions sources of said oxides, a
21 source of lithium or a mixture of lithium and another alkali metal and a templating
22 agent comprising a tetraethylammonium cation.

23

24 11. The method of claim 10 wherein the source of the alkali metal contains no alkali metal
25 other than lithium.

26

27 12. The method of claim 10 wherein the source of alkali metal contains lithium and
28 another alkali metal.

29

30 13. A method of preparing a crystalline material comprising an oxide of silicon, an oxide
31 of zinc and an oxide selected from aluminum oxide, boron oxide, gallium oxide,
32 vanadium oxide, iron oxide, titanium oxide or mixtures thereof and having the

- 1 framework topology of zeolite beta, wherein the molecular sieve contains zinc in its
2 crystal framework, said method comprising contacting in admixture under
3 crystallization conditions sources of said oxides, a source of lithium or a mixture of
4 lithium and another alkali metal and a templating agent comprising a
5 tetraethylammonium cation.
6
- 7 14. A method of removing a tetraethylammonium organic template from the pores of a
8 molecular sieve, said method comprising contacting the molecular sieve with acetic
9 acid or a mixture of acetic acid and pyridine at elevated temperature for a time
10 sufficient to remove essentially all of the tetraethylammonium organic template from
11 the molecular sieve.
12
- 13 15. The method of claim 14 wherein the molecular sieve has the topology of zeolite beta.
14
- 15 16. The method of claim 14 wherein the elevated temperature is 60°C or less.
16
- 17 17. The method of claim 14 wherein the elevated temperature is from about 80°C to about
18 135°C.
19
- 20 18. A method of removing an organic template from the pores of a molecular sieve and at
21 the same time removing zinc atoms from the framework of the molecular sieve,
22 wherein the molecular sieve comprises an oxide of silicon, an oxide of zinc and,
23 optionally, an oxide selected from aluminum oxide, boron oxide, gallium oxide,
24 vanadium oxide, iron oxide, titanium oxide and mixtures thereof, and having the
25 framework topology of zeolite beta, said method comprising contacting the molecular
26 sieve with acetic acid or a mixture of acetic acid and pyridine at elevated temperature
27 for a time sufficient to remove essentially all of the organic template and zinc from the
28 molecular sieve.
29
- 30 19. The method of claim 18 wherein the elevated temperature is about 60°C or less.
31
- 32 20. The method of claim 18 wherein the elevated temperature is from about 80°C to about

1 135°C.

2

3 21. A method of making a crystalline material comprising (1) contacting in admixture
4 under crystallization conditions a source of silicon oxide, a source of zinc oxide, a
5 source of lithium or a mixture of lithium and another alkali metal and a templating
6 agent comprising a tetraethylammonium cation until a crystalline material comprised
7 of oxides of silicon and zinc and having the topology of zeolite beta are formed, (2)
8 contacting the crystals with acetic acid or a mixture of acetic acid and pyridine at an
9 elevated temperature of about 60°C or less for a time sufficient to remove essentially
10 all of the organic template and zinc from the crystals, and (3) contacting the crystals
11 with a solution containing a source of aluminum, boron, gallium, iron, titanium,
12 vanadium, zirconium, tin or mixtures thereof.

13

14 22. The product produced by the method of claim 18.

15

16 23. The product produced by the method of claim 21.

17

18 24. A crystalline molecular sieve having the topology of zeolite beta, a crystal size of less
19 than one micron and a water adsorption capacity of less than 0.05 g/g of molecular
20 sieve.

21

22 25. A crystalline silicate molecular sieve having the topology of zeolite beta, a crystal size
23 of less than one micron and a water adsorption capacity of less than 0.05 g/g of
24 molecular sieve.

25

26 26. A method of preparing a crystalline material having the topology of zeolite beta
27 comprising impregnating a silica-containing mesoporous material with an aqueous
28 solution of tetraethylammonium cation in an amount sufficient to form a crystalline
29 product having the topology of zeolite beta, and wherein the water to mesoporous
30 material molar ratio is from about 0.5 to about 2, and subjecting the impregnated
31 mesoporous material to crystallizing conditions of heat and pressure for a time
32 sufficient to form crystals of a material having the topology of zeolite beta.

1

2 27. The method of claim 26 wherein the mesoporous material is an all-silica material.

3

4 28. The method of claim 26 wherein the mesoporous material comprises, in addition to
5 silica, an oxide selected from the group consisting of aluminum oxide, boron oxide,
6 titanium oxide, vanadium oxide, zirconium oxide, zinc oxide and mixtures thereof.

7

8 29. The method of claim 27 wherein the mesoporous material is MCM-41 or MCM-48.

9

10 30. The method of claim 28 wherein the mesoporous material is MCM-41 or MCM-48.

11

12 31. A process for converting hydrocarbons comprising contacting a hydrocarbonaceous
13 feed at hydrocarbon converting conditions with a catalyst comprising a molecular
14 sieve comprising an silicon oxide, zinc oxide, and an oxide selected from aluminum
15 oxide, boron oxide, gallium oxide, iron oxide, vanadium oxide, zirconium oxide, tin
16 oxide or mixtures thereof and having the framework topology of zeolite beta.

17

18 32. The process of claim 31 wherein the molecular sieve is predominantly in the hydrogen
19 form.

20

21 33. The process of claim 31 wherein the molecular sieve is substantially free of acidity.

22

23 34. The process of claim 31 wherein the process is a hydrocracking process comprising
24 contacting the catalyst with a hydrocarbon feedstock under hydrocracking conditions.

25

26 35. The process of claim 43 wherein the molecular sieve is predominantly in the hydrogen
27 form.

28

29 36. The process of claim 31 wherein the process is a dewaxing process comprising
30 contacting the catalyst with a hydrocarbon feedstock under dewaxing conditions.

31

32 37. The process of claim 36 wherein the molecular sieve is predominantly in the hydrogen

- 1 form.
- 2
- 3 38. The process of claim 31 wherein the process is a process for improving the viscosity
- 4 index of a dewaxed product of waxy hydrocarbon feeds comprising contacting the
- 5 catalyst with a waxy hydrocarbon feed under isomerization dewaxing conditions.
- 6
- 7 39. The process of claim 38 wherein the molecular sieve is predominantly in the hydrogen
- 8 form.
- 9
- 10 40. The process of claim 31 wherein the process is a process for producing a C₂₀₊ lube oil
- 11 from a C₂₀₊ olefin feed comprising isomerizing said olefin feed under isomerization
- 12 conditions over the catalyst.
- 13
- 14 41. The process of claim 40 wherein the molecular sieve is predominantly in the hydrogen
- 15 form.
- 16
- 17 42. The process of claim 40 wherein the catalyst further comprises at least one Group VIII
- 18 metal.
- 19
- 20 43. The process of claim 31 wherein the process is a process for catalytically dewaxing a
- 21 hydrocarbon oil feedstock boiling above about 350°F and containing straight chain and
- 22 slightly branched chain hydrocarbons comprising contacting said hydrocarbon oil
- 23 feedstock in the presence of added hydrogen gas at a hydrogen pressure of about 15-
- 24 3000 psi under dewaxing conditions with the catalyst.
- 25
- 26 44. The process of claim 43 wherein the molecular sieve is predominantly in the hydrogen
- 27 form.
- 28
- 29 45. The process of claim 43 wherein the catalyst further comprises at least one Group VIII
- 30 metal.
- 31
- 32 46. The process of claim 43 wherein said catalyst comprises a layered catalyst comprising
- 33 a first layer comprising the molecular sieve and at least one Group VIII metal, and a
- 34 second layer comprising an aluminosilicate zeolite which is more shape selective than

1 the molecular sieve of said first layer.

2
3 47. The process of claim 31 wherein the process is a process for preparing a lubricating oil
4 which comprises:

5
6 hydrocracking in a hydrocracking zone a hydrocarbonaceous feedstock to obtain an
7 effluent comprising a hydrocracked oil; and

8
9 catalytically dewaxing said effluent comprising hydrocracked oil at a temperature of at
10 least about 400°F and at a pressure of from about 15 psig to about 3000 psig in the
11 presence of added hydrogen gas with the catalyst.

12
13 48. The process of claim 47 wherein the molecular sieve is predominantly in the hydrogen
14 form.

15
16 49. The process of claim 47 wherein the catalyst further comprises at least one Group VIII
17 metal.

18
19 50. The process of claim 31 wherein the process is a process for isomerization dewaxing a
20 raffinate comprising contacting said raffinate in the presence of added hydrogen under
21 isomerization dewaxing conditions with the catalyst.

22
23 51. The process of claim 50 wherein the molecular sieve is predominantly in the hydrogen
24 form.

25
26 52. The process of claim 50 wherein the catalyst further comprises at least one Group VIII
27 metal.

28
29 53. The process of claim 50 wherein the raffinate is bright stock.

30
31 54. The process of claim 31 wherein the process is a process for increasing the octane of a
32 hydrocarbon feedstock to produce a product having an increased aromatics content

comprising contacting a hydrocarbonaceous feedstock which comprises normal and slightly branched hydrocarbons having a boiling range above about 40°C and less than about 200°C under aromatic conversion conditions with the catalyst.

55. The process of claim 54 wherein the molecular sieve is substantially free of acid.

56. The process of claim 54 wherein the molecular sieve contains a Group VIII metal component.

57. The process of claim 31 wherein the process is a catalytic cracking process comprising contacting a hydrocarbon feedstock in a reaction zone under catalytic cracking conditions in the absence of added hydrogen with the catalyst.

58. The process of claim 57 wherein the molecular sieve is predominantly in the hydrogen form.

59. The process of claim 57 wherein the catalyst additionally comprises a large pore crystalline cracking component.

60. The process of claim 31 wherein the process is a process for alkylating an aromatic hydrocarbon which comprises contacting under alkylation conditions at least a molar excess of an aromatic hydrocarbon with a C₂ to C₂₀ olefin under at least partial liquid phase conditions and in the presence of the catalyst.

61. The process of claim 60 wherein the molecular sieve is predominantly in the hydrogen form.

62. The process of claim 60 wherein the olefin is a C₂ to C₄ olefin.

63. The process of claim 62 wherein the aromatic hydrocarbon and olefin are present in a molar ratio of about 4:1 to about 20:1, respectively.

64. The process of claim 62 wherein the aromatic hydrocarbon is selected from the group

- 1 consisting of benzene, toluene, ethylbenzene, xylene, or mixtures thereof.
- 2
- 3 65. The process of claim 31 wherein the process is a process for transalkylating an
- 4 aromatic hydrocarbon which comprises contacting under transalkylating conditions an
- 5 aromatic hydrocarbon with a polyalkyl aromatic hydrocarbon under at least partial
- 6 liquid phase conditions and in the presence of the catalyst.
- 7
- 8 66. The process of claim 65 wherein the molecular sieve is predominantly in the hydrogen
- 9 form.
- 10
- 11 67. The process of claim 65 wherein the aromatic hydrocarbon and the polyalkyl aromatic
- 12 hydrocarbon are present in a molar ratio of from about 1:1 to about 25:1, respectively.
- 13
- 14 68. The process of claim 65 wherein the aromatic hydrocarbon is selected from the group
- 15 consisting of benzene, toluene, ethylbenzene, xylene, or mixtures thereof.
- 16
- 17 69. The process of claim 65 wherein the polyalkyl aromatic hydrocarbon is a
- 18 dialkylbenzene.
- 19
- 20 70. The process of claim 31 wherein the process is a process to convert paraffins to
- 21 aromatics which comprises contacting paraffins under conditions which cause
- 22 paraffins to convert to aromatics with a catalyst comprising the molecular sieve and
- 23 gallium, zinc, or a compound of gallium or zinc.
- 24
- 25 71. The process of claim 31 wherein the process is a process for isomerizing olefins
- 26 comprising contacting said olefin under conditions which cause isomerization of the
- 27 olefin with the catalyst.
- 28
- 29 72. The process of claim 31 wherein the process is a process for isomerizing an
- 30 isomerization feed comprising an aromatic C₈ stream of xylene isomers or mixtures of
- 31 xylene isomers and ethylbenzene, wherein a more nearly equilibrium ratio of ortho-,
- 32 meta and para-xylenes is obtained, said process comprising contacting said feed under
- 33 isomerization conditions with the catalyst.
- 34

- 1 73. The process of claim 31 wherein the process is a process for oligomerizing olefins
2 comprising contacting an olefin feed under oligomerization conditions with the
3 catalyst.
4
- 5 74. A process for converting lower alcohols and other oxygenated hydrocarbons
6 comprising contacting said lower alcohol or other oxygenated hydrocarbon under
7 conditions to produce liquid products with a catalyst comprising a molecular sieve
8 comprising silicon oxide, zinc oxide, and an oxide selected from aluminum oxide,
9 boron oxide, gallium oxide, iron oxide or mixtures thereof and having the framework
10 topology of zeolite beta.
11
- 12 75. In a process for the reduction of oxides of nitrogen contained in a gas stream in the
13 presence of oxygen wherein said process comprises contacting the gas stream with a
14 molecular sieve, the improvement comprising using as the molecular sieve a molecular
15 sieve comprising silicon oxide, zinc oxide, and an oxide selected from aluminum
16 oxide, boron oxide, gallium oxide, iron oxide, vanadium oxide, zirconium oxide, tin
17 oxide or mixtures thereof and having the framework topology of zeolite beta, wherein
18 the molecular sieve contains zinc in its crystal framework.
19
- 20 76. The process of claim 75 wherein said molecular sieve contains a metal or metal ions
21 capable of catalyzing the reduction of the oxides of nitrogen.
22
- 23 77. The process of claim 76 wherein the metal is copper, cobalt or mixtures thereof.
24
- 25 78. The process of claim 76 wherein the gas stream is the exhaust stream of an internal
26 combustion engine.
27
- 28 79. A method of removing liquid organic compounds from a mixture of liquid organic
29 compounds and water, comprising contacting the mixture with an all-silica molecular
30 sieve having the framework topology of zeolite beta, a crystal size less than one
31 micron and a water adsorption capacity of less than 0.05 g/g of molecular sieve.
32

1 80. A method of removing liquid organic compounds from a mixture of liquid organic
2 compounds and water, comprising contacting the mixture with a molecular sieve
3 comprising an oxide of silicon, an oxide of zinc and, optionally, an oxide selected
4 from aluminum oxide, boron oxide, gallium oxide, iron oxide and mixtures thereof,
5 and having the framework topology of zeolite beta, wherein the molecular sieve
6 contains zinc in its crystal framework.

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